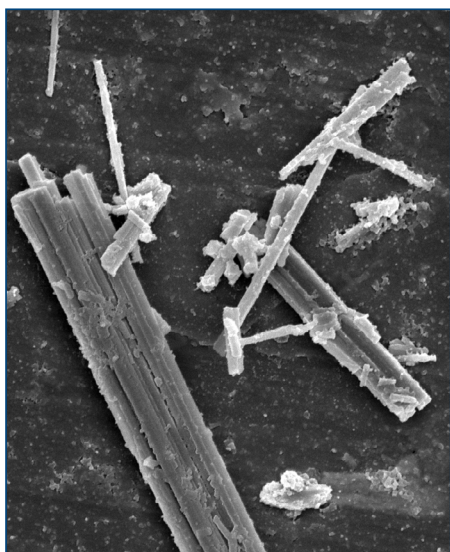


Superfund Research Program

The Superfund Research Program (SRP) supports practical research that creates benefits, such as lower environmental cleanup costs and reduced risk of exposure to hazardous substances, to improve human health. SRP funds colleges, universities, and small businesses, including the University of Pennsylvania Superfund Research Center (Penn SRC), to advance this work across the nation.

Research Highlights

Identifying social determinants of susceptibility to mesothelioma



Inhaled asbestos fibers can remain in lungs for a long time, increasing risk for lung disease. (Photo courtesy of Penn SRC)

Frances Barg, Ph.D., and her research team are working with a community in Ambler, Pennsylvania, to study lifestyle patterns and circumstances of asbestos exposure for links to cancer development. Asbestos is a group of minerals that occur naturally in the environment as bundles of fibers that can be separated into thin, durable threads. It is used to make many products, such as insulation and roofing, and is associated with mesothelioma. Mesothelioma is a cancer of the cells lining the lungs, abdominal cavity, and cardiac cavity caused by exposure to asbestos. About 6,000 people in Ambler live within a half-mile of a former manufacturing plant that disposed of over 1.5 million cubic yards of asbestos-containing waste products on the now cleaned up Superfund site.¹ Barg's team has formed strong relationships with the community that will help them collect information about community, occupational, and social factors that may contribute to the development of mesothelioma.

Flaxseed oil and new cancer prevention approaches

Two researchers at Penn SRC have launched a new project to explore whether dietary flaxseed oil can help prevent mesothelioma. Melpo Christofidou-Solomidou, Ph.D., and her team study the role of inflammation and oxidative damage in lung injury and disease. Inflammation and oxidative damage are immune-related responses that play a role in tissue damage.² In previous mouse studies, Christofidou-Solomidou showed that flaxseed oil, a natural antioxidant and dietary supplement, could prevent lung damage from radiation exposure.³ In collaboration with Steven Albelda, M.D., and his lab, they are studying whether dietary flaxseed oil may reduce oxidative stress and prevent mesothelioma tumor formation. Harnessing Albelda's expertise in clinical testing of treatments for lung-related diseases,⁴ Penn SRC hopes to test preventive treatments in patients.



Penn SRC researchers are exploring the possibility of using dietary flaxseed oil to help prevent lung diseases associated with asbestos exposure.



Penn SRC fosters problem-based, solution-oriented research related to asbestos transport, exposure, cleanup, and adverse health effects, in particular, mesothelioma. Their approach is to use environmental and biomedical research to advance scientific understanding, and to address environmental health concerns of government agencies and affected communities.

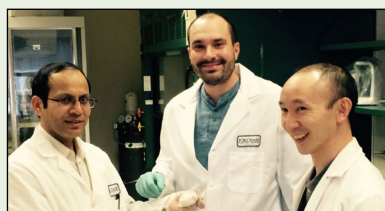
Center Contact:

Ian Blair, Ph.D.

University of Pennsylvania
Department of Pharmacology
ianblair@mail.med.upenn.edu
215-573-9880

Identifying the genetic basis of mesothelioma

Joseph Testa, Ph.D., and his team are combining genetic studies with mouse model research to better understand mesothelioma risk factors and prevention. The research has identified genetic mutations in a tumor suppressor gene associated with a high incidence of the disease.⁵ The mouse model they developed shows high similarity to human mesothelioma, including similarities in the types of tumor suppressor genes that are suggested to be important for tumor development.⁶ His team's findings were the first to link a genetic mutation to mesothelioma risk.



Penn SRC researchers, from left, Yuwaraj Kadariya, M.D., Ph.D.; Craig Menges, Ph.D.; and Mitchell Cheung, Ph.D., are working with Testa to better understand the role of genetics in mesothelioma. (Photo courtesy of Penn SRC)

The importance of studying asbestos

- Once asbestos particles are inhaled, they can remain there for a long time and cause lung scarring and inflammation.⁷
- Exposure to asbestos is associated with increased risk of lung cancer and mesothelioma.⁷

Research overview

- Understanding how tumors develop in mesothelioma. (Joseph Testa, Ph.D., joseph.testa@fcc.edu)
- Identifying biomarkers for asbestos exposure and mesothelioma. (Ian Blair, Ph.D., ianblair@mail.med.upenn.edu)
- Evaluating supplements that may lower risk of asbestos-induced mesothelioma. (Melpo Christofidou-Solomidou, Ph.D., melpo@mail.med.upenn.edu)
- Determining how asbestos moves in groundwater and identifying ways to prevent exposures. (Douglas Jerolmack, Ph.D., sediment@sas.upenn.edu)
- Finding new ways to clean up asbestos sites using plants and fungi. (Jane Willenbring, Ph.D., erosion@sas.upenn.edu)
- Identifying social determinants of risk in a community near an asbestos Superfund site. (Frances Barg, Ph.D., bargf@uphs.upenn.edu)

Sharing results

- Penn SRC translates knowledge and discoveries into actionable items by forging productive partnerships with the public and private sectors. (Richard Pepino, Ph.D., rpepino@sas.upenn.edu)
- Penn SRC fosters two-way exchange of knowledge among researchers and stakeholders in Ambler, Pennsylvania. (Edward Emmett, M.D., emmetted@mail.med.upenn.edu)

Other contributions to advance science

- The Penn SRC research support facility provides vital access to expertise, research resources, and state-of-the-art instrumentation for its research projects. (Wei-Ting Hwang, Ph.D., whwang@mail.med.upenn.edu)
- The Penn SRC integrated, multidisciplinary training experience provides early-career scientists access to teams of diverse professionals, and encourages innovation to develop solution-oriented approaches to complex environmental health problems. (Trevor Penning, Ph.D., penning@upenn.edu)

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NIEHS Contacts:

William Suk, Ph.D.

Director
Superfund Research Program
suk@niehs.nih.gov
919-541-0797

Danielle Carlin, Ph.D.

Program Administrator
Superfund Research Program
danielle.carlin@nih.gov
919-541-1409

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For more information on the National Institute of Environmental Health Sciences, visit www.niehs.nih.gov.

For more information on the Superfund Research Program, visit www.niehs.nih.gov/srp.

For more information on the University of Pennsylvania Superfund Research Center, visit www.med.upenn.edu/asbestos.

¹ EPA (U.S. Environmental Protection Agency). 2015. Ambler Asbestos Piles Current Site Information. Available: www.epa.gov/reg3hscd/npl/PAD000436436.htm [accessed 1 June 2015].

² Nowshien S, Aziz K, Kryston T, Ferguson N, Georgakilas A. 2012. The interplay between inflammation and oxidative stress in carcinogenesis. *Curr Molec Med* 12(6):672-680.

³ Pietrofesa RA, Solomides CC, Christofidou-Solomidou M. 2014. Flaxseed mitigates acute oxidative lung damage in a mouse model of repeated radiation and hyperoxia exposure associated with space exploration. *J Pulmon Respir Med* 4:215.

⁴ Stevenson JP, Kindler HL, Papasavvas E, Sun J, Jacobs-Small M, Hull J, Schwed D, Ranganathan A, Newick K, Heitjan DF, Langer CJ, McPherson JM, Montaner LJ, Albelda SM. 2013. Immunological effects of the TGFβ-blocking antibody GC1008 in malignant pleural mesothelioma patients. *Oncimmunol* 2(8):e26218.

⁵ Testa JR, Cheung M, Pei J, Below JE, Tan Y, Sementino E, Cox NJ, Dogan AU, Pass HI, Trusa S, Hesdorffer M, Nasu M, Powers A, Rivera Z, Comertpay S, Tanji M, Gaudino G, Yang H, Carbone M. 2011. Germline BAP1 mutations predispose to malignant mesothelioma. *Nat Genet* 43(10):1022-1025.

⁶ Altomare DA, Vaslet CA, Skele KL, De Rienzo A, Devarajan K, Jhanwar SC, McClatchey AI, Kane AB, Testa JR. 2005. A mouse model recapitulating molecular features of human mesothelioma. *Cancer Res* 65(18):8090-8095.

⁷ NCI (National Cancer Institute). 2009. Asbestos exposure and cancer risk.

Available: www.cancer.gov/about-cancer/causes-prevention/risk/substances/asbestos/asbestos-fact-sheet [accessed 1 June 2015].